EPA Region 5 Records Ctr.
257249

No. 1

Operations, Materials, Quantities

CORPORATE Milwaukee

II-A-12

REEL
2851

CODE
27

MILWAUKEE SOLVAY COKE COMPANY, INC.

II-A-12	Agreement between Milwaukee Solvay Coke Company and Milwaukee Gas Light Company providing for the supplying of natural gas to Milwaukee Solvay. Term: to March 1, 1961 and year to year thereafter	March 22, 1959
(b)	Assignment of (a) above to Wisconsin Coke Company, Inc.	June 1, 196[illegible]

Form 0-42-A

PICKANDS MATHER & CO.

Interoffice Communication

To Mr. G. A. Wilkin - Chicago Date December 10, 1973

From Mr. R. J. Norwick Copies to

Subject

The Agreement dated March 22, 1960 between Milwaukee Solvay Coke Co. and Milwaukee Gas Light Company, providing for the supply of natural gas to Milwaukee Solvay Coke Co. is currently on a year to year basis, with an anniversary date of March 1. Either party may terminate the Agreement upon 45 days written notice prior to the end of any such annual period. This item appears upon our calendar and we merely wish to bring it to your attention. In the event there is anything you wish to have done with respect to this Agreement, please advise.

RJN/ljh

Form G 45 A

PICKANDS MATHER & CO.

Interoffice Communication

To Mr. G. A. Wilken - Chicago

Date December 15, 1971

From Mr. R. J. Norwick

Copies to

Subject

The Agreement dated March 22, 1960 between Milwaukee Solvay Coke Co. and Milwaukee Gas Light Company, providing for the supply of natural gas to Milwaukee Solvay Coke Co. is currently on a year to year basis, with an anniversary date of March 1. Either party may terminate the Agreement upon 45 days written notice prior to the end of any such annual period. This item appears upon our calendar and we merely wish to bring it to your attention. In the event there is anything you wish to have done with respect to this Agreement, please advise.

RJN/jmk

Form G 42 A

PICKANDS MATHER & CO.

Interoffice Communication

To G. A. Wilken - Chicago

Date December 14, 1970

From R. J. Norwick

Copies to J. R. Lenz - Milwaukee Solvay

Subject

The Agreement dated March 22, 1960 between Milwaukee Solvay Coke Co. and Milwaukee Gas Light Company, providing for the supply of natural gas to Milwaukee Solvay Coke Co. is currently on a year to year basis, with an anniversary date of March 1. Either party may terminate the Agreement upon 45 days written notice prior to the end of any such annual period. This item appears upon our calendar and we merely wish to bring it to your attention. In the event there is anything you wish to have done with respect to this Agreement, please advise.

R. J. Norwick

T-A 12

ASSIGNMENT

This Agreement made and entered into this 1st day of June, 1962 among Milwaukee Gas Light Company (hereinafter called the "Gas Company"), Milwaukee Solvay Coke Company (hereinafter called "Milwaukee Solvay"), and Wisconsin Coke Company, Inc. (hereinafter called "Wisconsin"):

WITNESSETH:

WHEREAS, under date of March 22, 1960, the Gas Company and Milwaukee Solvay entered into an agreement providing for the supplying of natural gas to Milwaukee Solvay by the Gas Company, effective March 1, 1960, on the terms and conditions therein set forth (such agreement being hereinafter called the "Agreement"); and

WHEREAS, Wisconsin is acquiring substantially all of the operating assets of Milwaukee Solvay as of June 1, 1962, and it is the desire of all partier hereto that Wisconsin become the successor in interest of Milwaukee Solvay under the Agreement;

NOW, THEREFORE, in consideration of the premises, it is hereby mutually agreed:

1. Wisconsin shall succeed to all of the rights and obligations of Milwaukee Solvay under the Agreement, and shall be constituted the full and complete assignee thereof, subject to all of the terms and conditions in the Agreement set forth.

2. Wisconsin hereby expressly assumes and agrees to perform and abide by all obligations and conditions on the part

of Milwaukee Solvay to be kept and performed under the Agreement, and Milwaukee Solvay hereby assigns unto Wisconsin and relinquishes in favor of Wisconsin all rights therein.

3. Gas Company hereby expressly consents and agrees to the foregoing assignment on the conditions set forth above.

IN WITNESS WHEREOF, the parties have caused this Assignment to be executed as of the day and year first above written.

MILWAUKEE GAS LIGHT COMPANY

By Andrew W. Galm
Vice President-Sales

MILWAUKEE SOLVAY COKE COMPANY

By Albert P Mueller
Elec. Vice President

WISCONSIN COKE COMPANY, INC.

By S S Robinson
President

MILWAUKEE GAS LIGHT COMPANY

Milwaukee Solvay Coke Company
311 East Greenfield Avenue
Milwaukee 4, Wisconsin

Gentlemen:

This letter confirms our offer to continue to pro[illegible] gas service at your place of business located at 311 East Greenfi[illegible] Avenue, Milwaukee, Wisconsin.

It is our understanding that you agree to accept [illegible] gas service and purchase and use the same in accordance with th[illegible] terms and conditions of Rate Schedule Sg-3 (copy attached) and any [illegible]ture revisions thereof approved or ordered by the Public Service [illegible]mmission of Wisconsin.

Our mutual obligations under this agreement will continue for twelve (12) months from March 1, 1960 and thereafter from year to year until terminated by either party giving to the other at least forty-five days' written notice prior to the end of any such yearly period.

Please indicate that this letter states our agreement by signing two copies and returning them to us within ten days. The original is for your file.

Very truly yours,

MILWAUKEE GAS LIGHT COMPANY

By [signature]
Vice President

MILWAUKEE SOLVAY COKE CO.

By [signature]

Vice President
Title

March 22, 1960

MILWAUKEE GAS LIGHT COMPANY

East Wisconsin Avenue · Milwaukee

Broadway 6-6720

Milwaukee Solvay Coke Company
311 East Greenfield Avenue
Milwaukee 4, Wisconsin

Gentlemen:

This letter confirms our offer to continue to provide gas service at your place of business located at 311 East Greenfield Avenue, Milwaukee, Wisconsin.

It is our understanding that you agree to accept such gas service and purchase and use the same in accordance with the terms and conditions of Rate Schedule Sg-3 (copy attached) and any future revisions thereof approved or ordered by the Public Service Commission of Wisconsin.

Our mutual obligations under this agreement will continue for twelve (12) months from March 1, 1960 and thereafter from year to year until terminated by either party giving to the other at least forty-five days' written notice prior to the end of any such yearly period.

Please indicate that this letter states our agreement by signing two copies and returning them to us within ten days. The original is for your file.

Very truly yours,

MILWAUKEE GAS LIGHT COMPANY

By Floyd Klein
Vice President

MILWAUKEE SOLVAY COKE CO.

By [signature]

Vice President
Title

March 22, 1960

GAS DOES IT BETTER... automatically!

MILWAUKEE GAS LIGHT COMPANY

626 EAST WISCONSIN AVENUE

ELECTION OF MINIMUM CHARGE

BILLING OPTION

Milwaukee Solvay Coke Company
311 East Greenfield Avenue
Milwaukee, Wisconsin

Re: Rate Sg-3, Large Volume Interruptible

Option I: The monthly minimum charge will be billed each month.

Option II: Accumulate in consecutive months charges for gas consumed equal to twelve times the monthly minimum charge.

In accordance with the above rate schedule we elect to be billed by the method described in Option II.

MILWAUKEE SOLVAY COKE COMPANY

By [signature]

Vice President

March 22, 1960

LARGE VOLUME INTERRUPTIBLE

AVAILABILITY

Available to all customers on yearly contracts.

RATE

		Gross	Net
First	15,000 therms or less per month	$1,275.00	$1,125.00
Over	15,000 therms per month -- (per therm)	.050	.045

The monthly minimum charge is $1,275.00 gross, $1,125.00 net. In lieu of the monthly minimum charge, the customer may elect, under this rate step, to accumulate in consecutive months during the contract year, charges of $13,500.00 for gas consumed, and all gas consumed during the balance of the contract year shall be billed at the rate of $.050 per therm gross, $.045 per therm net.

METER READING AND BILLING

The Company will read meters under this rate monthly. Net bills for each month's consumption are due and payable on the tenth day of the month following; thereafter the gross rate will be due and payable.

SPECIAL TERMS AND PROVISIONS

1. Meters

This schedule applies to gas furnished in any one month to one customer at one location through one meter. Where, at the Company's option, two or more meters are installed on the same premises for the same customer, the amount of gas supplied through all such meters will be combined in arriving at the total charge, and the minimum bill will be the same as though one meter were installed.

LARGE VOLUME INTERRUPTIBLE | GAS

SPECIAL TERMS AND PROVISIONS (Cont'd)

2. Interruption

Gas service under this schedule may be interrupted or curtailed whenever the available supply of natural gas is insufficient in the sole opinion of the Company to meet the requirements of the Company's firm and Sg-2 Rate customers and customers under this schedule.

The Company will give the customer as much advance notice of an interruption or curtailment as feasible; such notice will normally be not less than four hours. The customers shall discontinue the use of gas within the period of time specified in such notice.

The purchase of gas under any other rate schedule to replace the natural gas interrupted or curtailed hereunder is not permitted. Upon notice from the Company that service has been restored, the customer shall immediately resume the use of gas. No other fuel shall be used in lieu of natural gas when service is available under this rate.

3. Standby Equipment

The customer shall continuously provide and maintain standby facilities, and the fuel required for the operation thereof, of sufficient capacity to make possible the interruption of gas service hereunder.

COST OF GAS ADJUSTMENT CLAUSE

The commodity rate (5 cents per therm gross and 4.5 cents per therm net) is based on the Company's cost of purchased natural gas under Michigan Wisconsin Pipe Line Company's Rate Schedule ACQ-1. Such rates shall be increased or

MILWAUKEE GAS LIGHT COMPANY

SCHEDULE

AMENDMENT NO. 00

LARGE VOLUME INTERRUPTIBLE	TYPE OF UTILITY GAS

COST OF GAS ADJUSTMENT CLAUSE (Cont'd)

decreased by 0.01 cent per therm for each full 0.1 cent per Mcf increase or decrease in the Company's average unit cost of firm natural gas supply, effective as of the same date that a change in cost becomes effective.

If the Company receives a refund on gas purchased resulting from Federal Power Commission action, a corresponding refund per therm shall be made to customers served under this rate to the extent that such refund results from disallowance of an increased cost of gas which has been passed on to customers served under this rate.

February 5, 1969

AUTHORIZATION OF PUBLIC SERVICE COMMISSION OF WISCONSIN BY

DATE

February 1, 1969

Mr. Sauer
2 cop for Co.

June 10th, 1959

American Natural Gas Company
666 Penobscot Building'
Detroit 26, Michigan

Dear Sirs:

Pursuant to your request we have made a study of the operations of the Milwaukee Solvay Coke Company (hereinafter referred to as the Coke Company and of the effect of such operations on the Milwaukee Gas Light Company (hereinafter referred to as the Gas Company), for the purpose of determining (a) if the Coke Company is being operated most effectively and (b) the most desirable arrangements for the future between the Coke Company and the Gas Company.

This study was made with the assistance of Mr. A.C. Sedlachek, Manager of the Everett Massachusetts Works and Mr. F.D. Miller, Superintendent of the Philadelphia Coke Division, both of Eastern Gas and Fuel Associates. Visits were made to the Milwaukee plant and down town office for the purpose of inspecting plant facilities and analyzing plant operating data and costs.

The Coke Company has been in operation for over fifty years and much of the equipment is very old and could not economically be replaced under present conditions. While the merchant coke industry is a declining industry the Coke Company is favorably situated with respect to markets at the present time and can be expected to continue profitable operation by affecting all possible economies. The Coke Company has been generally well managed and with the exception of the commitment to supply a minimum of 60,000 therms per day of coke oven gas for use by the Sewerage Commission and the continuation of the firing of natural gas and solid fuels instead of low cost coke oven gas, operating decisions have been generally sound.

Following are our conclusions regarding the effectiveness of operation of the Coke Company and our recommendations for future operations.

(1) The commitment to deliver a minimum of 60,000 therms per day of coke oven gas for consumption by the Sewerage Commission was ill-advised. In order to produce this quantity of coke oven gas the plant would have to operate at a charging rate of 2100 tons per day with a coking time of twenty-three hours, which condition is only possible when running to produce largely furnace coke. There has not been a year since entering into the Coke Oven Gas Contract that the market for furnace coke has been sufficient to permit this production. At the present operating rate of about 1000 tons per day coal charge the failure to produce the minimum contact of coke oven gas costs the Coke Company about $60,000 annually.

(1) (2) The remaining principal market available to the Coke Company is the market for high quality foundry coke. Production of this product requires coking times of at least thirty hours which limits plant capacity to a maximum of 1600 tons per day of coal charge. The Coke Company anticipates that markets will require increasing the present operating rate from 1000 to 1350 tons per day. The surplus coke oven gas available at these three operating rates if the gas is not fired in the boiler or if it is fired with and without electric power generation is as follows:

	Average Daily Therms of Coke Oven Gas for Daily Operating Rates of:		
	1000 Tons	1350 Tons	1600 Tons
Surplus if Not Fired	23,600	32,400	42,700
Surplus if Fired with Electric Generation	300	5,700	14,200
Surplus if Fired With Power Purchased	6,150	12,200	21,300

The production of coke oven gas measured in therms per day per ton of coal carbonized is comparable to that obtained by other plants in the industry so that the failure fo make the contemplated volume of surplus coke oven gas is the result of lower coal throughput and not of lower plant efficiency. The report gives a tabulation of the surplus coke oven gas that can be expected by months for the above operating rates and for various conditions of boiler firing and electric power generation.

(3) Actual costs of maintaining the producer and petroleum plants in standby condition are estimated at $32,500 so that the Coke Company profits from the $100,000 standby fee under the Coke Oven Gas Contract.

(2)(4) Operating practices other than fuels used for firing the boilers are generally good.

(a) The present method of operating all batteries at longer coking times is preferable to banking one of the batteries and pushing the others at shorter coking times.

(b) Coke yield is good approaching 80% of coal charged, and the yield of the larger sized foundry and furnace coke is good, in the range of 72%, further indicating the quality of operation.

(c) The practice of using two shifts with some overtime at the present low throughput results in a monthly dollar saving over the use of three shift operation.

(d) In addition to some $5,500 annually of standby or idle time in the producer and petroleum plants it is indicated that some labor saving could be effected by consolidating certain foreman and assistant foreman classifications. It is estimated that a maximum of fifteen employees might be affected.

(e) The agreements with union labor are as good or better than those of other plants in the industry.

(f) The supervisory personnel at the plant are capable and experienced men doing a creditable job.

(g) By-product coal chemical yields are somewhat below industry average and the economics of recovery is only slightly profitable to marginal. The principal by-product prices are dropping and as the market for these by-products changes further and as major maintenance expenditures or capital additions are required, the economic desirability of continuing by-product recovery should be reviewed.

(5) The Coke Company should stop firing all solid fuels and natural gas and fire its own coke oven gas in the boilers. Rather than selling coke oven gas at the present prices paid by the Sewerage Commission or even at the heat equivalent price of natural gas delivered by Michigan Wisconsin the Coke Company should have been burning its own coke oven gas. Natural gas at the gas company's Special Industrial rate schedule is more costly than coke oven gas. Because of the high costs of handling and maintenance of equipment the cost of solid fuels is much more expensive than coke oven gas. It is estimated that the firing of coke oven gas can save $183,000 annually over the present method of burning natural gas and solid fuels. Boiler conversion to permit firing with 100% coke oven gas with provisions for natural gas and solid fuel standby is estimated at $60,000 which will pay out of savings after income taxesin less than one year.

(3) ~~(6)~~ The saving by purchasing electric power rather than generating it is not sufficient to give an attractive pay out of the required investment in rectifier equipment to permit purchasing electric power. Instead of going to purchased power at this time it is believed that the motor generator set should be operated at its maximum continuous load capabilities (instead of for peak load) so as to produce a maximum amount of power and minimize the amount generated. With this method of operation a saving in boiler house costs will be realized without any added capital investment.

(4) ~~(7)~~ From observation of plant condition it is indicated that if operation is to be continued for more than a few years an additional expenditure of about 60¢ per ton of coal carbonized or $250,000 annually will be required for maintenance in excess of the amount planned to be spent.

The Gas Company has entered into a new contract with the Sewerage Commission as of May 1st, 1959 (subject to approval of the Wisconsin Public Service Commission) which, upon approval, will terminate the old contract. This new contract will place the Sewerage Commission on a large volume rate schedule pricing heat units irrespective of the type of gas supplied so that there will no longer be any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day.

The Gas Company proposes to ride out the Coke Oven Gas Contract until it terminates September 1, 1960 under which it pays the contract price amounting to about 3.3¢ per therm of coke oven gas plus the annual standby fee of $100,000. After the Coke Oven Gas Contract expires the Gas Company proposes to buy surplus coke oven gas without a contract in the quantities and at the times that it is available at the heat equivalent of natural gas received from Michigan Wisconsin which is presently 3.75¢ per therm. The Gas Company does not propose to renew the standby arrangement.

Following are our conclusions regarding the most desirable arrangements for the future between the Coke Company and the Gas Company.

(1) By continuing the Coke Oven Gas Contract until its natural termination in September, 1960, the Coke Company will receive a lower price for its gas but this loss estimated at about $15,000 represents a gain of the same amount to the Gas Company. The continuation of the standby fee is estimated to benefit the Coke Company some $67,500 annually over its actual costs.

(2) If the two part rate proposal of Michigan Wisconsin is not approved and the Gas Company is faced with curtailing the attachment of space heating customers during the forthcoming heating season, it would be desirable to use coke oven gas to permit continued attachment of space heating customers rather than place any further impediments in the way of the nicely-growing space heating business.

(3) If the Coke Company plant is operated at the expected rate of 1350 tons of coal charge per day producing 32,400 therms per day, a maximum of some 2300 space heating customers could be supplied. Each space heating customer is worth about $93 annually to the Gas Company. The cost of purchasing natural gas to make coke oven gas available for this purpose would be about $17 annually so that the net benefit to the American Natural Gas System would be some $76 a year per space heating customer supplied with coke oven gas.

(4) Because of the severe penalty provision of the Michigan Wisconsin tariff it is important not to take on any more excess space heating customers than can be supplied each month with coke oven gas. The Coke Company plans to be at the 1350 ton per day operating rate by September and if this plan materializes and if conditions at that time indicate continued coking at this rate during the winter, it would appear reasonable to take on up to about 2000 excess space heating customers. Added gross profit from this source to the American Natural Gas System could amount to $150,000 during the next year.

(5) It is indicated that Michigan Wisconsin will be able to keep its Special Industrial customers on the line during the 1959-60 heating season so that natural gas purchases to replace coke oven gas in the boilers may not be interrupted. In case of interruptions the Coke Company can fire solid fuels at increased costs.

(6) The prospects for additional gas after the 1959-60 season are believed to be sufficiently good so that the Gas Company should not be getting into a position in which it would have to rely upon coke oven gas after the 1959-60 season.

(7) After the termination of the Coke Oven Gas Contract in September, 1960 the Coke Company should continue to fire the maximum amount of coke oven gas in its boilers to generate its steam requirements and sell surplus gas when and in the volumes available from time to time. The Coke Company might make such a sale to the Gas Company or it might make an arrangement directly with the Sewerage Commission at a better price.

(5) ~~(8)~~ The present natural gas connection should be maintained to provide make up fuel during periods of deficient coke oven gas production and to provide natural gas for fuel when coke oven gas is being sold to the Gas Company for space heating purposes.

The report upon which the above conclusions and recommendations are based is attached.

Very truly yours,

Chas. R. Hetherington & Co. Ltd.

Chas. R. Hetherington

Milwaukee Solvay Coke Company

REPORT ON THE OPERATIONS OF

MILWAUKEE SOLVAY COKE COMPANY

Chas. R. Hetherington & Co. Ltd.

June 1959

CONTENTS

CHARTS

TABLES (Not included in this report)

PLOT PLAN

SECTION 1

THE OPERATIONS OF

THE MILWAUKEE SOLVAY COKE COMPANY

REPORT ON THE OPERATIONS
OF MILWAUKEE SOLVAY COKE COMPANY

June 1, 1959

INTRODUCTION

The Milwaukee Solvay Coke Company (hereinafter referred to as the Coke Company), a subsidiary of the American Natural Gas Company system and thereby an affiliate of the Milwaukee Gas Light Company (hereinafter referred to as the Gas Company), owns a merchant coke plant located on deep water within the City of Milwaukee, Wisconsin, for the production of coke, coke oven gas and coal chemicals. Coke oven gas is sold to the Gas Company and, prior to the advent of natural gas in 1949, was a principal source of gas supply for the Gas Company. The Coke Company has been in operation for over 50 years and the management has had to alter its operations and policies to meet a wide variety of varying conditions over the years.

With the advent of natural gas to Milwaukee, supplied by Michigan Wisconsin Pipe Line Company (hereinafter referred to as Michigan Wisconsin, also a subsidiary of the American Natural Gas Company system), the Gas Company in its desire to avoid the distribution of mixed coke oven and natural gas worked out a ten-year arrangement to sell all of the coke oven gas produced by the Coke Company to the Sewerage Commission of the City of Milwaukee, (hereinafter referred to as the Sewerage Commission). A companion contract was entered into between the Coke

Company and the Gas Company (hereinafter referred to as the Coke Oven Gas Contract) for the sale of the coke oven gas to the Gas Company.

Various difficulties have arisen in operating under the Coke Oven Gas Contract and the contract with the Sewerage Commission, and recently the Gas Company has negotiated a more favorable agreement with the Sewerage Commission which will become effective and terminate the old contract as of May 1, 1959, subject to the approval of the Public Service Commission of Wisconsin. The Coke Oven Gas Contract will terminate on September 1, 1960, pursuant to notice given as provided in the contract.

A study has been made of the operations of the Coke Company and of the effect of such operations on the Gas Company to determine (a) if the Coke Company is being operated most effectively, and (b) the most desirable arrangements for the future between the Coke Company and the Gas Company, both until the termination of the Coke Oven Gas Contract in 1960, and thereafter. This report is divided into two sections, dealing with these matters as follows:

Section 1:	The Operations of The Milwaukee Solvay Coke Company.
Section 2:	The Future Sale of Coke Oven Gas Between The Coke Company and The Gas Company.

Section 1 deals with the following principal subjects:

1. The Coke Company Plant.
2. Coke Oven Gas Production and Sale
   - (a) The Coke Oven Gas Contract
   - (b) Coke Oven Gas Yield
   - (c) Economics of Standby Operation
3. Other Plant Operations
   - (a) Operating Practices
   - (b) By-Product Yields
   - (c) Firing Alternate Fuels and Power Generation
4. Maintenance and Plant Condition

Conclusions and recommendations are summarized in the letter of transmittal for this report.

THE COKE COMPANY PLANT

The Coke Company plant is located at 311 East Greenfield Avenue on 41.8 acres of land fronting on deep water of the Kinnickinnic River, providing access to Great Lakes and ocean shipping. The plant is served by the Chicago, Milwaukee, St. Paul and Pacific Railway; the Milwaukee, Chicago and Northwestern Railway; and the Chesapeake and Ohio Railway car ferry. A layout of the plant is shown in the attached Plot Plan.

The coking facilities consist of 200 ovens in four batteries. Two of the batteries are of the Solvay type with 40 ovens in one battery and 60 in the other. The other two batteries are of the Koppers type with 50 ovens each. The Koppers ovens are 17-inch ovens with some 30 feet long while the Solvay ovens are 17-inch ovens some 36 feet long, each with a nominal coal charge capacity of eleven tons at a bulk density of 50 pounds per cubic foot. Actual coal charge is about ten tons per oven or 2,000 tons for the plant of 200 ovens. The nominal capacity of the plant is about 2,000 tons per day of coal charge to produce 1600 tons per day of furnace, foundry and other cokes. When operating on foundry coke the plant capacity is 1600 tons per day of coal charge.

The Koppers ovens are equipped with heat regenerators, while the Solvay ovens use recuperative heat recovery in by-product steam generators. The ovens have compound firing and, although coke oven gas is normally fired, the Koppers ovens can be fired with producer gas while the Solvay ovens can be fired with petroleum-enriched producer gas. There is a producer gas plant with a capacity of 38,000 therms per day and a liquified petroleum gas plant with a capacity of 14,400 therms per day, making a total gas generating capacity of 52,400 therms daily.

The plant is equipped with screens and crushers to provide the sizes desired for foundry and furnace use and the smaller egg, stove, nut, range, pea and breeze.

The gas recovery system consists of facilities to remove and recover crude tar including naphthalene, an ammoniacal water solution which is concentrated to 26% ammonia and light oils which are fractionated into benzol, toluol and mixed xylols. Neither pyridine nor sulphur are recovered. Waste liquor is disposed of to the Sewerage Commission and sulphur is left in the coke oven gas.

The boiler plant consists of eight boilers with a total capacity of 4,000 boiler horsepower, two of which are converted for the firing of gas as well as solid fuels. [and 2 are converted to gas only] The power plant consists of ~~four~~ three steam engine driven generators, two steam turbine driven generators and a motor generator set with a combined capacity of 3,100 [2300] kilowatts of direct current.

The plant is complete with other appurtenant facilities, such as gas holders, gas compressors to transfer the coke oven gas and a water system from the river to provide cooling water and fire protection. As noted on the Plot Plan, the plant site is provided with ample dockage, railway spurs and a 480 foot coal stacking and reclaiming bridge.

The plant, out of necessity due to its age, is equipped with machine shop, pipe shop and other services required to keep the equipment in operation. A railroad system is employed throughout the plant to handle coke movement except for storage and reclaiming of coke which is done by truck.

Coal is received at the plant from April 1st to December 15th and is stacked in individual piles and impacted to protect against spontaneous combustion. Daily needs of coal for processing are transferred from the stock piles by conveyor belt and are proportioned as required by the mix being coked. The coal is weighed, mixed and crushed and then conveyed to the coke oven bins from whence it is charged to the oven chambers by overhead cars.

At present foundry coke is screened into desired sizes and sold. Currently the market is taking all foundry coke production while running at an operating rate of 1,000 tons per day of coal charge, along with additional coke that is being reclaimed from inventory. At times when the market does not absorb all coke production it is loaded into trucks and hauled to a storage area where it is stocked until such time as it is needed. At present some 70% of coke production is of 3 in. and over foundry quality while the remainder is smaller sizes and breeze which are sold for industrial and domestic purposes.

The gas produced from the coal carbonized is drawn from the ovens by means of exhausters located in the by-products building. This gas is cooled for the extraction of tar, ammonia solution and light oil products. Coke oven gas production is first used for underfiring of the ovens and any surplus is compressed to about ~~9~~ 7 lbs. per square inch pressure for delivery to ~~the Sewerage Commission~~. the boiler house, the surplus delivered to the Sewerage Commission.

The Coke Company handles its own sales of domestic coke in Milwaukee County while the other sales, including foundry, furnace, industrial and domestic are handled by the Company's agent, Pickands, Mather & Company. The coal chemicals, ammoniacal liquor, benzol, toluol and xylol are sold through Nitrogen Products, Inc.

COKE OVEN GAS PRODUCTION AND SALE

The Coke Oven Gas Contract:

The Coke Oven Gas Contract of August 22, 1950, under which the Coke Company sells its coke oven gas to the Gas Company obligates the Coke Company to deliver a minimum of 60,000 therms and up to 67,000 therms if available of surplus coke oven gas a day to be paid for at a price per therm equal to the average cost of coal per therm to the Wisconsin Electric Power Company, which price has been running about 3.3¢ per therm.

The Coke Oven Gas Contract also provides that the Coke Company will maintain its producer plant and liquified petroleum gas plant in standby condition so that the Coke Company will be able to deliver during periods of emergency, a total quantity of gas up to 110,000 therms per day. For this standby service the Coke Company receives a standby fee of $100,000 annually.

The Coke Company has experienced the wide fluctuations in market conditions, characteristic of the merchant coke business. Since a merchant coke plant supplies what might be termed peak load coke requirements of the iron and steel industry, such a plant is the first to suffer a reduced market during times of reduced steel production. In addition, since the time of entering into the Coke Oven Gas Contract, the steel companies have built up coking capacity of their own to provide for over 85% of their requirements for furnace coke and accordingly, the market for furnace coke has continually decreased until today, there appears to be little expectation of any substantial market for this grade of coke, except in case of a national emergency.

The following tabulation indicates the trend in coke sales volume and distribution:

	Year	Annual Sales Tons				Per cent
		Furnace	Foundry	Other	Total	Furnace Coke
	1950	147,622	223,470	141,005	512,097	43.6%
	1951	208,377	236,962	83,003	528,342	39.4
	1952	191,987	227,304	80,825	500,116	38.4
	1953	261,241	214,638	73,330	549,209	47.8
	1954	-	177,442	61,999	239,441	0.0
	1955	170,833	265,539	66,998	503,370	33.9
	1956	57,060	249,555	78,678	385,293	14.8
	1957	94,632	198,959	72,501	366,092	25.9
	1958	33,876	172,022	62,263	268,161	12.6
(3 months)	1959	-	60,483	17,813	78,296	0.0

The Coke Company, then has as a necessity been concentrating on the foundry business and hopes to build its foundry coke sales back to the 250,000 ton level of the better years of the last decade.

With reduced coke production and operation on foundry coke, the Coke Company has been unable to produce the minimum contracted quantity of 60,000 therms per day of coke oven gas. Under the agreement between the Gas Company and the Sewerage Commission for the sale of the coke oven gas, the Gas Company has been required to make up this deficiency in coke oven gas by supplying higher cost natural gas, and since the Gas Company has sustained damages, it has had to enforce the minimum delivery provisions of the Coke Oven Gas Contract and charge the Coke Company with the added cost of supplying natural gas which presently costs about 3.75¢ per therm. At present production rates of 23,000 therms per day this added charge is costing the Coke Company about $60,000 annually (37,000 therms deficiency x 365 days x $0.0045).

The Gas Company has entered into a new contract with the Sewerage Commission as of May 1, 1959 (subject to approval of the Wisconsin Public Service Commission) which, upon such approval, will terminate the old contract. This new contract will place the Sewerage Commission on a large volume rate schedule pricing heat units irrespective of the type of gas supplied so that there will no longer be any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day.

The Gas Company proposes to ride out the Coke Oven Gas Contract until it terminates September 1, 1960, under which it pays the contract price amounting to about 3.3¢ per therm plus the annual standby fee of $100,000.

After the Coke Oven Gas Contract expires, the Gas Company proposes to buy surplus coke oven gas without a contract in the quantities and at the times that it is available at the heat equivalent of natural gas received from Michigan Wisconsin which is presently 3.75¢ per therm. The Gas Company does not propose to renew the standby arrangement.

Coke Oven Gas Yield:

The shift from furnace to foundry coke has required a shift in operation. While furnace and domestic coke can be produced with a coking time as short as 17 hours, high quality foundry coke requires a coking time of about 30 hours. Since plant capacity is reduced in inverse proportion to the coking time, maximum plant capacity producing foundry coke is 1600 tons per day of coal charge.

The Coke Company operates all of its ovens at all times regardless of the amount of production desired and regulates the amount of production by adjusting the coking time. Accordingly, the coking time is set by the amount of production desired and not by quality requirements other than for the minimum coking time needed to produce quality foundry coke. For this type of operation with an average coal charge of 2,000 ton the daily coke production is related to coking time as follows:

C = Coal Charge in Tons per day

T = Coking Time in Hours

$$C = \frac{2000 \times 24}{T} = \frac{48,000}{T}$$

The attached Chart No. 1 shows actual plant coal charge for various coking times. Over the past ten years the average coking time has been increased from about 24 hours to 48 hours.

Since the production of coke oven gas from a charge declines rapidly after about 20 hours, while the requirements for coke oven gas for underfiring fuel continues for the full period of coking, the net production of coke oven gas is less at longer coking times. Radiation heat losses from the ovens and the impracticability of continuously adjusting the firing to individual ovens results in increased consumption of coke oven gas with increased coking time. Further, the longer coking times give more time for flue gas to leak into the ovens which dilutes the coke oven gas with carbon dioxide and nitrogen thereby reducing the heat content per cubic foot.

The attached Table No. 1 shows by months the coal charge by types and times of coking time along with surplus coke oven gas production, heat content and specific gravity. The attached Chart No. 2 based upon these data shows the decline in net coke oven gas production and the decline in heating value with increases in coking time for the plant.

The attached Table No. 2 shows how the composition of the coke oven gas varies with coking time. The effect of flue gas leakage is indicated by the substantial increase in nitrogen content for the longer coking time.

In order to produce the minimum quantity of coke oven gas of 60,000 therms per day, specified in the Coke Oven Gas Contract, the plant would have to operate on a 23-hour coking time charging 2100 tons of coal per day. At this condition the net coke oven gas production would be 28 therms per ton which is comparable to the production obtained by other plants in the industry. This condition is only possible when running to produce a substantial tonnage of furnace coke and there has not been a year since entering into the Coke Oven Gas Contract that the market for furnace coke has been sufficient to permit production of 60,000 therms per day of coke oven gas.

At present operating rates of about 1000 tons per day with a 48-hour coking time, the plant produces about 23,600 therms per day of net coke oven gas or 23.5 therms per ton.

The Coke Company anticipates markets which will require running at an operating rate of 1350 tons daily, starting in September, and at this rate the coking time would be 36 hours and gas production would be about 32,400 therms per day. At the maximum capacity of the plant when running for foundry coke of 1600 tons per day of coal charge with a coking time of 30 hours, the maximum coke oven gas production that can be expected is about 42,700 therms per day.

The amount of this coke oven gas that would be available for sale depends upon whether the gas is fired in the boilers and whether electric power is generated or purchased.

The following tabulation gives the reductions that could be made at three plant operating rates in the amount of power generated, steam produced, and gas fuel fired by purchasing power.

Operating Rate - Tons per Day Coal	1000	1350	1600
Annual Power Requirement - KWH	7,350,000	7,960,000	8,390,000
Less Power Purchased - KWH	2,000,000	2,000,000	2,000,000
Power Presently Generated - KWH	5,350,000	5,960,000	6,390,000
Possible Reduction in Generation-KWH (1)	4,750,000	5,360,000	5,790,000
Increase in Power Purchased-KWH (2)	5,280,000	5,950,000	6,430,000
Annual Reduction in Steam if Power is purchased - M. lb.	150,000	167,000	184,000
Annual Reduction in gas Fired if Power is purchased - Therms	2,130,500	2,370,600	2,608,800

Note (1) - Some 600,000 KWH annually can be generated on surplus process steam during times when the ammonia concentration plant is down, and would not require purchase.

(2) - Increase in power purchased is greater than the reduction in power generated because of 90% rectifier efficiency.

The attached Table No. 3 gives an estimate of the net surplus coke oven gas that will be available by months at three operating rates of 1000, 1350 and 1600 tons of coal charge per day if (a) coke oven gas is not fired in the boilers, (b) if coke oven gas is fired and electric power is generated, and (c) if coke oven gas is fired and electric power is purchased. The average day net surplus coke oven gas available under these conditions is summarized as follows:

	Average Daily Therms of Coke Oven Gas for Daily Operating Rates of:		
	1000 tons	1350 tons	1600 Tons
Surplus if Not Fired	23,600	32,400	42,700
Surplus if Fired with Electric Generation	300	5,700	14,200
Surplus if Fired with Power Purchased	6,150	12,200	21,300

While there is a net surplus of coke oven gas production over a year there would not be sufficient gas during the five winter months to meet all boiler fuel requirements when operating at the 1000 ton per day coal charge rate and producing power. These monthly deficiencies are shown in attached Table No. 3. The source of natural gas supply to the plant should be maintained to provide make up fuel during such periods of deficiency in coke oven gas for firing and for emergency purposes.

Economics of Standby Operation:

On the books of the Coke Company the Producer and Petroleum Plants are charged with actual cost expended on the plants and with an allocation of costs of other departments. The attached Table No. 4 gives a statement of costs for the year 1958 which were charged to the Producer and Petroleum Plants on the books along with an estimate of the actual cash costs that would not be incurred if the plants were dismantled.

(A)

Out of the $84,035 charged to the plants on the books only about $32,500 would be actually saved by abandoning the facilities. About two-thirds of saving would be in property taxes and insurance.

Part of the time of certain supervisory and operating personnel (1/2 to 2 hours per day) is charged to the plants. Abandonment of these facilities would save this time but there would not be any reduction in costs. Similarly, there would be certain savings of repair labor fractional hours but no personnel would be eliminated.

Eight operating personnel receive from 10¢ to 49¢ per hour above certain base rates for standing ready to operate these plants and an engineer devotes a substantial portion of his time to these plants. These costs amounting to $5,550 annually which are carried under "idle time" would be saved by abandoning the facilities.

Certain operating supplies, repair materials and a portion of the allocated costs of the service departments would be saved. Depreciation is not an item of saving since any remaining book value of the facilities not depreciated when the plants are abandoned and dismantled ($82,963 as of December 31, 1958) would be charged against surplus as an abandonment loss.

Since the major part of the labor expense is on a part-time fractional hour basis so that these employees would not be eliminated and since certain allocated costs of other departments would not actually be saved, the actual cost attributable to the Producer and Petroleum Plants is about $32,500 annually. The Coke Company profits from the $100,000 standby fee.

OTHER PLANT OPERATIONS

Operating Practices:

The plant is operated so that desired throughput is obtained by adjusting the coking time. At the lower throughputs and longer coking times coke oven gas yields are reduced and carbon which normally seals the refractory is burned out of the ovens so that flue gas leaks into the coke oven gas (see Chart No. 2 for effect upon BTU content). Consideration was given to the economics and practability of banking one battery of ovens so that the remaining three batteries could be operated on a faster coking schedule. Decreasing the coking time would improve coke oven gas yield and would increase carbon on the walls of the ovens.

Fuel required to bank the one oven battery shut down would be about 10% of that required for coking and hence a substantial volume of fuel would be used to keep the battery warm. No saving is made in man power since the same number of ovens must be pushed in a given period and the increase in coke oven gas production is offset by the fuel required to keep the one battery warm. While more frequent pushing of the ovens in operation, maintenance expenses would be expected to increase and accordingly it is indicated that the present method of operation is to be preferred.

It is suggested that the operators of the plant experiment to produce foundry coke pushing warmer without changing its quality in an effort to seal the walls of the ovens more effectively with carbon.

With the procedures employed at the plant a good coke yield approaching 80% of coal charged has been consistently obtained. This yield is above industry average. Coke quality also has been above that of the general industry and the yields of the larger sized foundry and furnace coke have been good, in the range of 72%, further indicating the quality of operation. Attached Table No. 5 shows the production of coke from coal and the production of the larger foundry and furnace cokes out of total coke produced.

At the present throughput of about 1000 tons per day with a coking time of 48 hours, the operating forces have been reduced to two shifts per day. Attached Table No. 6 gives the cost for operating labor with two shifts as compared to three for the present operating rate. Only the operation of the ovens and coke handling are affected by this type of operation. By using two shifts instead of three there is a reduction of twelve jobs and a monthly saving of $6,700 in direct labor costs exclusive of fringe benefits.

In addition to selling current production the plant is presently reclaiming foundry coke from stock to meet market requirements and certain of the personnel are worked overtime in connection with the reclaiming operation. Attached Table No. 7 gives the cost of labor for the coke handling department for this two shift operation with overtime as compared to three shift operation which shows a direct labor saving exclusive of fringe benefits of some $3,800 a month.

Operation with two shifts does not necessarily of itself entail additional overtime work. The temporary reclaiming of coke from stockpile results in some overtime being paid to men who work on the two shift basis. During the first three months of 1959 overtime was also paid to men working on the rush completion of crushing and screening apparatus. Table No. 8 gives an analysis of man hours and cost for operation and maintenance for the year 1957 during which three shifts were worked and for the year 1958 during which two shifts were worked. During 1957 with three shifts, overtime pay ran about $4,300 per month or about 10¢ per ton of coal charged. During 1958 with two shifts, overtime ran about $2,500 per month or about 9¢ per ton of coal charged. Plant operating statistics do not indicate any excessive overtime as a result of the two shift operation and, in fact, indicate a reduction.

For low operating rates the two shift method of operation results in reduced labor costs and accordingly is desirable. The Company has been on a two shift basis since January, 1958 and at the present time proposes to continue to operate on this basis until capacity is increased to 1,350 tons per day in September of 1959, at which time it is planned to resume three shift operation.

In addition to the some $5,500 annually of standby or idle time as described in the previous section of this report under "Economics of Standby Operation", there appears to be a possibility of effecting further labor savings by consolidating certain of the foreman and assistant foreman job classifications. In other plants which have effected similar economies the duties being performed by some fifteen employees of this class have been consolidated to reduce the number of supervisory personnel.

The labor agreements between the Coke Company and the Unions is a better than average contract in the industry. Wage scales are not out of line and, in fact, are lower than in many plants, and operating restrictions though bothersome are not as severe as in other similar contracts in the industry.

The supervisory personnel at the plant are capable and experienced men doing a creditable job.

By-Product Yields:

While the yield of coke from coal is exceptionally good (in the range of 80%), the yield of coal chemicals from the antiquated recovery system is somewhat less than would be expected from the average coke plant. Comparative yields of coal chemicals are as follows:

	Coal Chemical Yields per Ton of Coal Coked	
	Coke Company Plant	Average Industry
Tar	6.9 Gallons	7.4 Gallons
Ammonia	3.9 Pounds	6.5 Pounds
Aromatics	2.3 Gallons	2.9 Gallons

Part of the lower by-product yield, particularly in the case of ammonia is the result of the higher percentage of low volatile coal used in the manufacture of foundry coke, while the remainder is the result of low efficiency of the recovery equipment.

The revenue from these by-products though substantial in dollar amount is a relatively small proportion of total revenue as indicated by the following revenue figures, and the Coke Company has not felt justified in the face of decreasing by-product prices in revamping, or in cases, repairing recovery equipment.

	Year	Revenue from Coal Chemicals	Total Revenue	Per Cent of Revenue from Coal Chemicals
	1952	$ 1,123,798	$ 11,849,903	9.5%
	1953	1,144,982	13,189,828	8.7
	1954	636,849	6,335,250	10.0
	1955	862,265	11,855,494	7.3
	1956	878,355	10,501,104	8.4
	1957	834,335	10,271,107	8.1
	1958	582,509	7,678,566	7.6
(3 months)	1959	138,800	2,387,777	5.8

The economics of by-product recovery were reviewed and based on actual costs it is indicated that recovery is only slightly profitable to marginal. On the basis of costs actually incurred and allocated against the recovery units the recovery operations would not appear economic, however, the abandonment of these operations would not result in the saving of the book costs that are presently charged to the operations.

In the case of light oil recovery the gas must be cleaned of naphthaline to prevent plugging in gas mains and accordingly certain minimum expenditures are required. In the case of ammonia the recovery unit could be shut down if it were desired, and the ammonia liquor diverted to the sewage plant as has been done in the past during periods of downtime on the ammonia recovery unit.

The trend in prices obtained for by-product coal chemicals is shown in Attached Table No. 9. Since 1952 the price of tar and ammonia has increased while the price of light oils has decreased markedly. As the market for these by-products changes and as major maintenance expenditures or capital additions to the by-product recovery system are required an analysis should be made to determine the economic desirability of continuing by-product recovery.

FIRING ALTERNATE FUELS AND POWER GENERATION

The boiler house is equipped with 4- 600 HP and 4 - 400 HP boilers presently equipped for firing fuels as follows:

Boiler Number	Boiler Horsepower	Fuel
1	600	Gas or Coal
2	600	Gas or Coal
3	600	Coke
4	600	Coke Breeze and Coal
5	400	Coke Breeze and Coal
6	400	Coal
7	400	Coke Breeze and Coal
8	400	Coal

In the past there has been little market for coke breeze, and this material has been mixed with 25 to 30 per cent coal and fired for steam generation. Coal and natural gas have been used to make up the remaining heat requirements.

Coke breeze has been valued at its heating value of about 5/6 of that of coal or $6.17 per ton. Recently, a good and apparently continuing market is developing for coke breeze at about $8.00 per ton for use in the benefaction of taconite iron ores, and accordingly coke breeze has a greater value for sale than for fuel. The Coke Company has gradually been reducing the tonnage of coke breeze and coal fired and has replaced these fuels with natural gas. Presently, no coke breeze is being fired.

While coke oven gas has a sales value of about 3.3¢ per therm, any of this gas used in the past has had to be replaced by natural gas at Michigan Wisconsin prices (presently 3.75¢ per therm) for delivery to the Sewerage Commission. Accordingly, coke oven gas has had a value to the Coke Company of 3.75¢ per therm. It is difficult to understand why the Coke Company would buy natural gas at 4.7¢ per therm when it could burn its coke oven gas at 3.75¢ per therm.

Now that the Coke Company is not to be required to pay increased natural gas prices for coke oven gas production below 60,000 therms per day, coke oven gas has a lower value of 3.3¢ per therm and there is even more advantage to firing coke oven gas instead of natural gas.

Solid Fuels vs. Gas: As previously noted the Coke Company is presently firing coal and natural gas. In order to indicate the relative economics of firing various fuels, the actual plant costs which vary with the type of fuel used have been analyzed. Since the amount of steam generated, and hence costs, depend upon whether electric power is generated or purchased, these costs which vary with the type of fuel fired have been considered both for generating and for purchasing electric power along with the costs which vary with the generation or purchase of power.

The attached Table No. 10 gives a comparison of the costs which vary with the type of fuel fired and with electric generation for (a) the firing of solid fuels only, (b) the firing of both solid fuels and natural gas and (c) the firing of gas only at various prices, all for the anticipated operating rate of 1350 tons per day of coal charge.

The quantity of steam, electric power and fuel required are shown at the top of the table. Steam and total power requirements are taken from plant operating data since 1952 as shown on attached Chart No. 3. Recently about 2,000,000 KWH have been purchased annually, and this quantity was taken as the amount to be purchased if electric generation is to be continued. If electric power is to be purchased it is estimated that surplus steam will be available on weekends when the ammonia concentration plant is down, to generate 600,000 KWH annually and purchased power would be reduced by this amount.

Fuel requirements to generate steam in the existing boiler equipment are taken at the following plant experience figures:

Fuel	Steam Generated
Coke Breeze	10,000 lbs. per ton
Coal	12,000 lbs. per ton
Gas	70.5 lbs. per therm

The costs which vary with the type of fuel fired are the fuel cost and the cost of boiler house operation and repair. Fuels are taken at their present values of $7.40 per ton for coal (and coke equivalent), 3.3¢ per therm for coke oven gas and 4.7¢ per therm for natural gas. In the columns dealing with gas firing the total costs are also shown for gas values of 3.75¢ and 4.7¢ per therm. Boiler house incremental operating and repair costs are taken from plant experience as shown on attached Chart No. 4.

The costs which vary with electric generation are the cost of power and power house incremental costs. Electric power at present consumption levels costs about 1.7¢ per KWH. The Wisconsin Electric Power Company prepared an estimate of 1.4¢ per KWH for purchase of full plant requirements. Power house incremental costs are taken from recent experience.

The costs which vary with the type of fuel fired and with electric generation are summarized from Table No. 10 as follows:

	Annual Variable Costs When Generating Power	Annual Variable Costs For Purchasing Power
Solid Fuel Firing	$ 612,000	$ 539,000
Solid Fuel and Natural Gas Firing	561,000	495,000
Gas Firing for Gas @ 3.3¢ per therm	378,000	356,000
@ 3.75% per therm	425,000	389,000
@ 4.7¢ per therm	514,000	459,000

In order to fire coke oven gas it will be necessary to change the orifice sizes in the burners in Numbers 1 and 2 boilers and install gas burners in Numbers 3 and 4 boilers. The estimated costs of this conversion including the removal of the stokers in Numbers 3 and 4 is $60,000.

The payout of this conversion cost by firing coke oven gas instead of solid fuels and natural gas is very attractive as follows:

	With Power Generation	For Purchasing Power
Variable Costs from Table No. 10:		
For Firing Solid Fuels and Natural Gas at present	$ 561,000	$ 495,000
For Firing Coke Oven Gas at 3.3¢ per Therm	378,000	356,000
Gross Saving	183,000	139,000
Less Income Taxes	96,000	72,000
Net Saving	$ 87,000	$ 67,000
Conversion:		
Cost	$ 60,000	$ 60,000
Payout	0.7 years	0.9 years

Since the payout is prior to the termination of the Coke Oven Gas Contract, a price of 3.3¢ per therm is taken for coke oven gas.

It is quite clear that the Coke Company should stop firing all solid fuels and natural gas and fire its own coke oven gas, whether or not electric power is generated or purchased. Savings over the present method of operation are estimated at $183,000 annually and at $139,000 annually if electric power is purchased.

Power Generation vs. Purchase: The power house is equipped with very old equipment to produce 250 volt D.C. power as follows:

Generator Number	KW	Drive	Energy Source
1	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
2	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
3	200	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
4	(a)	Engine	150 lb. Steam Exhausting to 150 or 3 lb.
5	600	Turbine	150 or 3 lb. Steam Condensing
6	600	Turbine	150 or 3 lb. Steam Condensing
7	1000	Motor-Generator	Purchased Power
Total -	2800		

Note (a) - This 300 KW unit broke down and is out of service.

Because of the ease of control the Coke Company uses the motor generator set to take the main swings on plant power requirements. Accordingly, purchased power supplies peak load requirements and minimum power is purchased.

Rectifier equipment is required to convert purchased power into D.C. for plant use. In order to meet peak load demands some 1750 KW of rectifying capacity should be provided. The cost of a 1000 KW and a 750 KW mercury arc rectifier is estimated at $200,000 installed, based on advice from Allis-Chalmers Manufacturing Company. The payout of this investment depends upon the type of fuel and its cost as shown in the following tabulation:

Variable Costs from Table No. 10:	Natural Gas and Solid Fuel Firing	3.3¢/Therm	Firing with Gas at 3.75¢/Therm	4.7¢/Therm
With Power Generation	$ 561,000	$ 378,000	$ 425,000	$ 514,000
For Purchasing Power	495,000	356,000	389,000	459,000
Gross Saving	66,000	22,000	36,000	55,000
Less Income Tax	32,000	8,000	16,000	26,000
Net Saving	$ 34,000	$ 14,000	$ 20,000	$ 29,000
Conversion:				
Cost	$ 200,000	$ 200,000	$ 200,000	$ 200,000
Payout	5.9 years	14.2 years	10.0 years	6.9 years

The payout of the investment to permit purchasing electric power is not particularly attractive for the present operation when firing solid fuels and natural gas, and is particularly unattractive when firing coke oven gas at 3.3% per therm.

Instead of going to purchased power at this time it is believed that the motor generator set should be operated at its maximum continuous load capabilities (instead of for peak load) so as to purchase a maximum amount of power and minimize the amount generated. With this method of operation, a saving in boiler house costs will be realized without any added capital investment.

When coke oven gas is valued at the price of natural gas delivered by Michigan Wisconsin, the conversion becomes somewhat more attractive and if the advent of Canadian gas further increases the price of Michigan Wisconsin gas, and hence the value of coke oven gas, the economics of the conversion improve further. As the value of coke oven gas increases and as absolute need to replace or major repair present generating equipment arises, consideration can then be given to making the investment required to permit purchasing electric power. Other conditions at that time can also be taken into consideration.

MAINTENANCE AND PLANT CONDITION

As a matter of policy, the plant has for some time been undertaking only day to day maintenance and has deferred a substantial amount of maintenance required to keep the plant in continuing operating condition. In past years some $1,000,000 annually or about $1.40 per ton of coal charged was expended on maintenance. In recent years this has been reduced to some $500,000 annually or about $.80 per ton. This procedure has resulted in cash savings in the past.

From observations of plant condition it is indicated that if operation is to be continued for more than a few years an additional expenditure in excess of the amount planned to be spent for maintenance must be made. An additional 60¢ per ton or $250,000 annually is estimated to be required for continued operations.

The ovens themselves are of principal importance since if allowed to deteriorate their replacement could not be justified under present economic conditions. The operating management is giving careful attention to this equipment but is limiting repairs to a necessary minimum.

As stated previously herein the concentration of ammonia and the fractionation of light oil by-products is marginal and rather than maintain these facilities in top condition it is believed desirable to continue recovery of these products until major replacement of facilities is required at which time abandonment should be considered. This same consideration applies with respect to power generation.

SECTION 2 ru6

THE FUTURE SALE OF COKE OVEN GAS BETWEEN

THE COKE COMPANY AND THE GAS COMPANY

PRIOR TO TERMINATION OF THE COKE OVEN GAS CONTRACT

The Gas Company plans to "ride out" the Coke Oven Gas Contract until it terminates September 1, 1960. This is a sound plan and appears to be the best arrangement possible, both for the Coke Company and for the American Natural Gas Company system. Under the new arrangement between the Gas Company and the Sewerage Commission in which there is no longer any necessity to charge the Coke Company for the added cost of natural gas used to make up deficiencies in coke oven gas production below 60,000 therms per day, the Coke Oven Gas Contract can operate to the benefit of the Coke Company regardless of the low price established for coke oven gas in this contract.

During the period until termination of the Coke Oven Gas Contract some 18 months hence, coke oven gas will be priced at the heat equivalent of coal presently about 3.3¢ per therm. If the contract were cancelled now, coke oven gas could be priced at its value equivalent to natural gas delivered by Michigan Wisconsin which is presently 3.75¢ per therm. It has been recommended previously herein that the Coke Company burn its coke oven gas under its boilers so that a minimum volume of coke oven gas would be sold. If the Coke Company sells net surplus gas in the amount of 6,000 therms per day for the next 18 months (3,300,000 therms), the loss in revenue to the Coke Company for sale at 3.3¢ per therm as against 3.75¢ per therm is only about $15,000.

Since this loss in revenue to the Coke Company represents a gain in revenue to the Gas Company there is no net effect upon the American Natural System. As previously noted herein, the actual cost of holding the producer and petroleum plants for standby is about $32,500 annually, so that net cash of some $67,500 annually or over $100,000 during the next 18 months will be obtained under the standby arrangement.

Accordingly, the Coke Company and the American Natural system will benefit during the next 18 months by keeping the Coke Oven Gas Contract in effect, until it expires.

3. THE BY-PRODUCT COKE OVEN INDUSTRY

3.1 GENERAL

Coke is the almost pure carbon residue that is left when most of the volatile matter in coal is removed by destructive thermal distillation. Nearly all coke is made by gradually heating a blend of pulverized coals to high temperatures (900 to 1,000°C) for 10 to 40 hours. Approximately 99 percent of the United States' annual coke production is made by "slot-oven" or by "by-product" coking. (The remainder is made in "beehive" or other types of ovens where by-products are not recovered.) The names "slot-oven" and "by-product" are descriptive of the equipment and process. The conversion of coal to coke is typically performed in narrow, long "slot" ovens which are designed and operated to permit separation and recovery of the volatile materials (the by-products) evolved during the coking process.

Coke is used by the steel and foundry industries. Most coke plants are associated with and produce coke for use in blast furnaces (blast-furnace coke) in integrated iron and steel plants. Independent plants which produce coke for sale on the open market are referred to as "merchant" coke producers, and their product is called "merchant" coke. In 1975, approximately 90 percent of the coke produced was used in blast furnaces, 2 percent was exported, and the remainder used primarily in foundries. Sixty-five plants with an estimated 231 batteries and 13,324 ovens produce coke.[1] Eighty to 85 percent of the batteries product blast furnace coke.

As can be seen on Figure 3-1, by-product coke plants tend to be concentrated north of the Ohio and east of the Mississippi Rivers. Most are located in urban industrial areas.

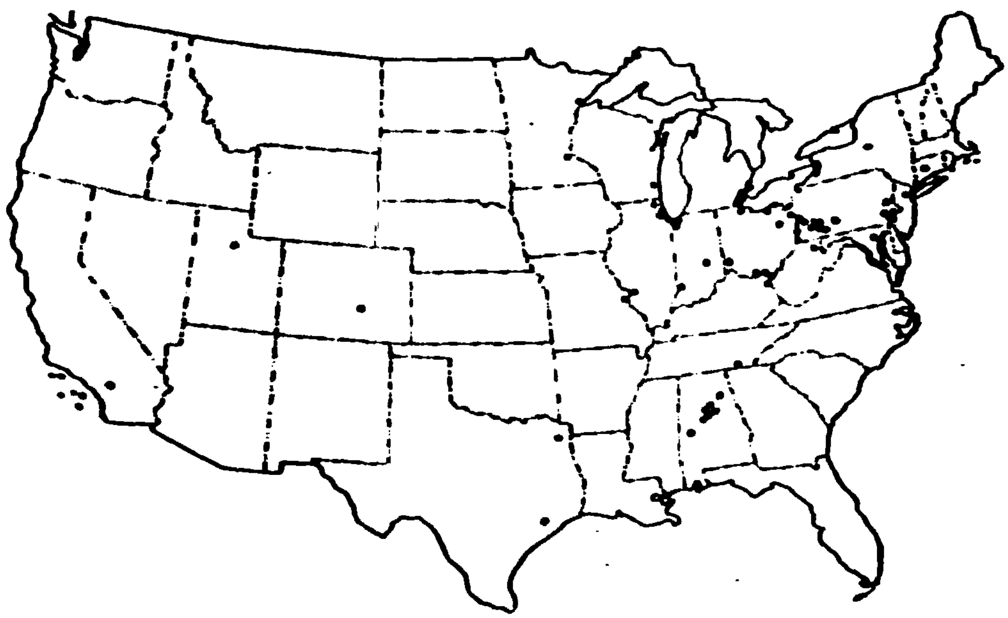

FIGURE 3-1. Distribution of coke plants in the United States

A typical coke oven battery will have about 58 ovens, each with a net capacity of 16 megagrams (18 tons) of coal, and produce about 1300 megagrams (blast-furnace) coke per day. New batteries, however, are expected to be much larger, over 70 ovens each with a net capacity of 29 megagrams (32 tons). They will produce over 2000 megagrams of coke per day. (If the coal is preheated, production could be over 3000 megagrams per day.)

Typical products and by-products from a domestic by-product coke plant are shown in Table 3-1.

Table 3-1. COKE AND COAL CHEMICALS PRODUCED BY U. S. COKE PLANTS IN 1973

Product	Yield: Per megagram coal charged	Yield: Per ton coal charged
Coke	0.6878 megagram	0.6878 net ton
Breeze	0.0531 megagram	0.0531 net ton
Crude Tar	34.75 liters	8.33 gallons
Crude Light Oil	10.22 liters	2.45 gallons
Ammonia (sulphate equivalent)	6.77 kilograms	13.54 pounds
Coke Oven Gas	331 cubic meters[a]	11,700 cubic feet[a]

[a]Estimated

Coke from the ovens is crushed and screened. "Breeze" is the term given the undersize coke from the screening operation. Although not completely standardized, breeze generally refers to coke that will pass through a 1.27 centimeter (1/2-inch) screen. By-products driven off by the distillation process, fuel gas (heat value of 20.5 million joules/cubic meter), light aromatic oils, and tar are used internally or marketed.

3.2 BY-PRODUCT COKING PROCESS

A by-product coke plant can be divided into three subprocesses: (1) coal preparation, (2) thermal distillation (coke production), and (3) by-product production. The first two are illustrated in Figure 3-2.

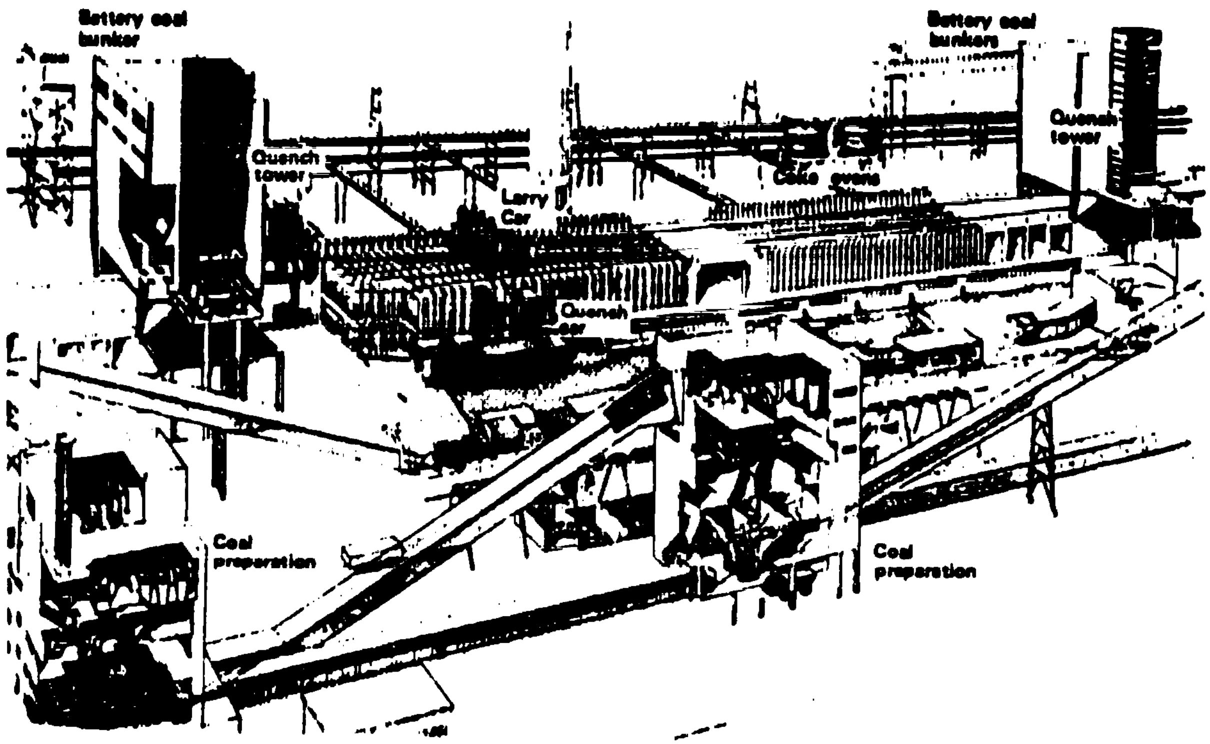

Figure 3-2. By-Product Coke Plant.

3.2.1 Coal Preparation

A blend of two or more low, medium, or high volatile coals is the feed to a by-product coking process. Blending is necessary to achieve the desired properties of the coke, to provide the optimum in types and amounts of by-products, and also to avoid a coal mix that by expansion causes excessive pressure on the oven walls during the coking process.

Before blending, the coal is pulverized to some preselected size between 3.2 (1/8-inch) and 0.15 mm (0.006-inch). (The most desirable size depends on the response of the coal to coking reactions and the ultimate coke strength desired. Low volatile coal cokes more readily if the particle size is small. Smaller particles are also reported to give hgiher strength to the coke.) The pulverized coals are then mixed in blending bins, followed by a final blending operation in mixers. Water and oil may be added to control the bulk density of the coal mixture. The prepared coal mixture is transported to the coal-storage bunkers on the coke-oven batteries.

3.2.2 Thermal Distillation

The separation of volatile and nonvolatile components of the coal takes place in coke batteries. These consist of between 20 and 100 adjacent ovens with common side walls made of high-quality silica and other types of refractory brick which contain integral flues. Typial dimensions of individual slot ovens are 3.6 to 6.7 meters (12 to 22 feet) high, 12.2 to 16.8 meters (40 to 55 feet) long, and 0.36 to 0.51 meters (14 to 20 inches) wide. Heat for the coking operation is provided by a regenerative combustion system located below the ovens. A cut-away section of a battery is shown in Figure 3-3. The slot ovens operate like chemical retorts in that they are batch-operated, fitted with exhaust flues (called standpipes or offtake pipes), and function without addition of any reagent.

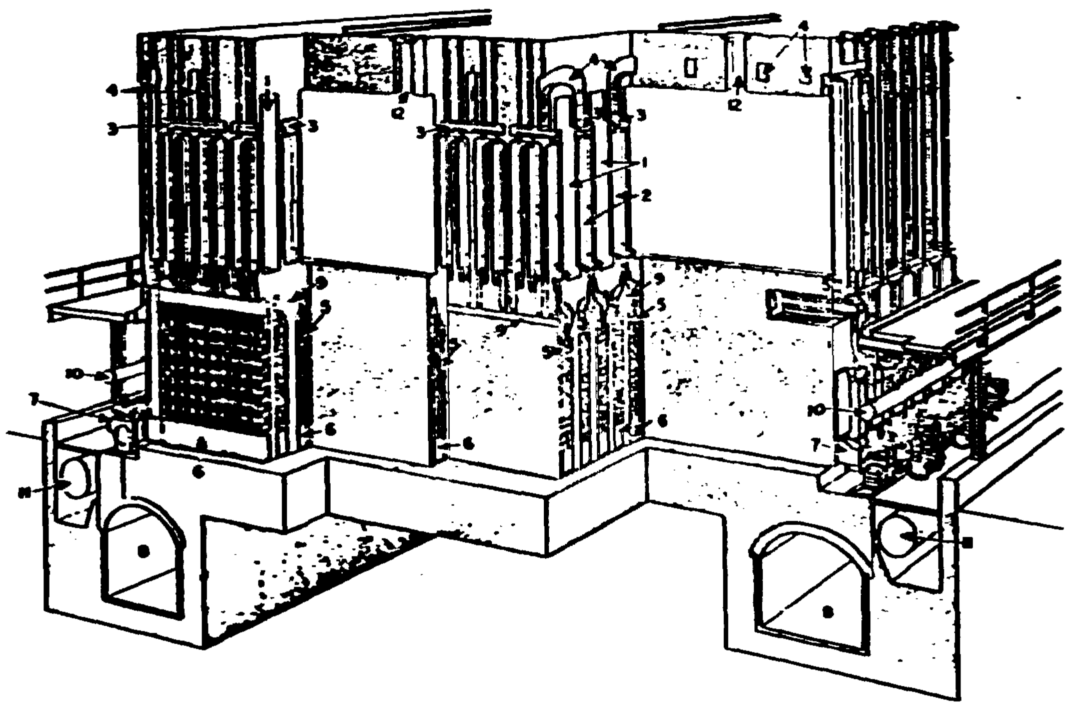

Figure 3-3. Cut-away Section Showing Coke Ovens and Heating System

1. Oven chamber. 2. Vertical combustion flues. 3. Horizontal flues. 4. Cross-over flues. 5. Regenerators. 6. Oven sole flues. 7. Gas and air connections to waste-gas flue. 8. Waste-gas flues. 9. Gas ducts for coke-oven gas. 10. Oven gas main. 11. Blast-furnace gas main. 12. Charging holes.

A flow chart for the coke battery is presented as Figure 3-4. First, a weighed amount or volume of prepared coal is discharged from the bunker into the larry car, a vehicle driven by electric motors which travels the length of the battery on a wide-guage railroad track (see Figure 3-5). The larry car contains the coal in hoppers which have discharge chutes to transfer the coal into the slot ovens. As shown in Figure 3-6, the larry car is positioned over an empty oven with the lids on the coal-charging ports removed, and the coal is discharged into the ovens. Coal may flow by gravity or rotary table or screw feeders may be used to control the rate of flow from the hoppers.

Figure 3-7 shows a view of the top or "topside" of a typical battery which has four charging holes per oven in rows of two between the larry car rails and one outboard of each. (Although most batteries have four charging ports per oven, some have three or five.) The larry car can barely be distinguished at the far end of the battery. It is beneath the coal bunker being filled.

As the coal flows into an oven, peaks will form directly under the charging ports. These peaks will interfere with uniform coking of the coal and are eliminated as shown on Figure 3-6. A steel "leveling bar" is cantilevered from the pusher machine through a "chuck" door on the pusher side[1/] of the battery and moved back and forth across the top of the coal. Leveling the coal also provides a clear vapor space for gases that evolve from the charged coal to flow to the standpipes and gas mains. A row of standpipes is visible to the right of the battery in Figure 3-7. Many batteries have a second row of standpipes (one on each end of each oven).

[1/]Pusher side designates the side of the battery where the pusher machine is located.

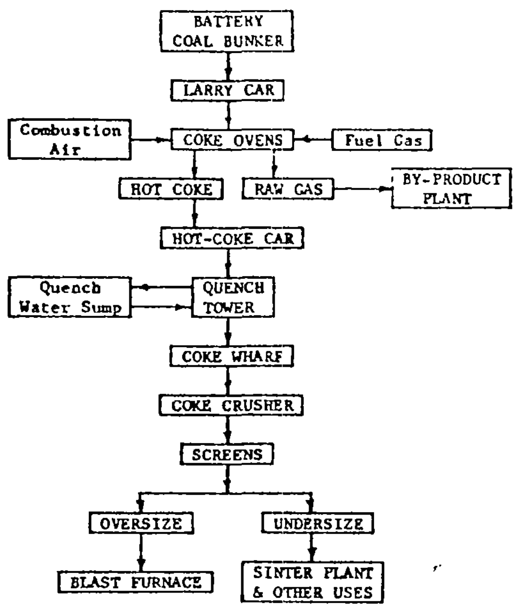

Figure 3-4. Coke Battery Flow Chart

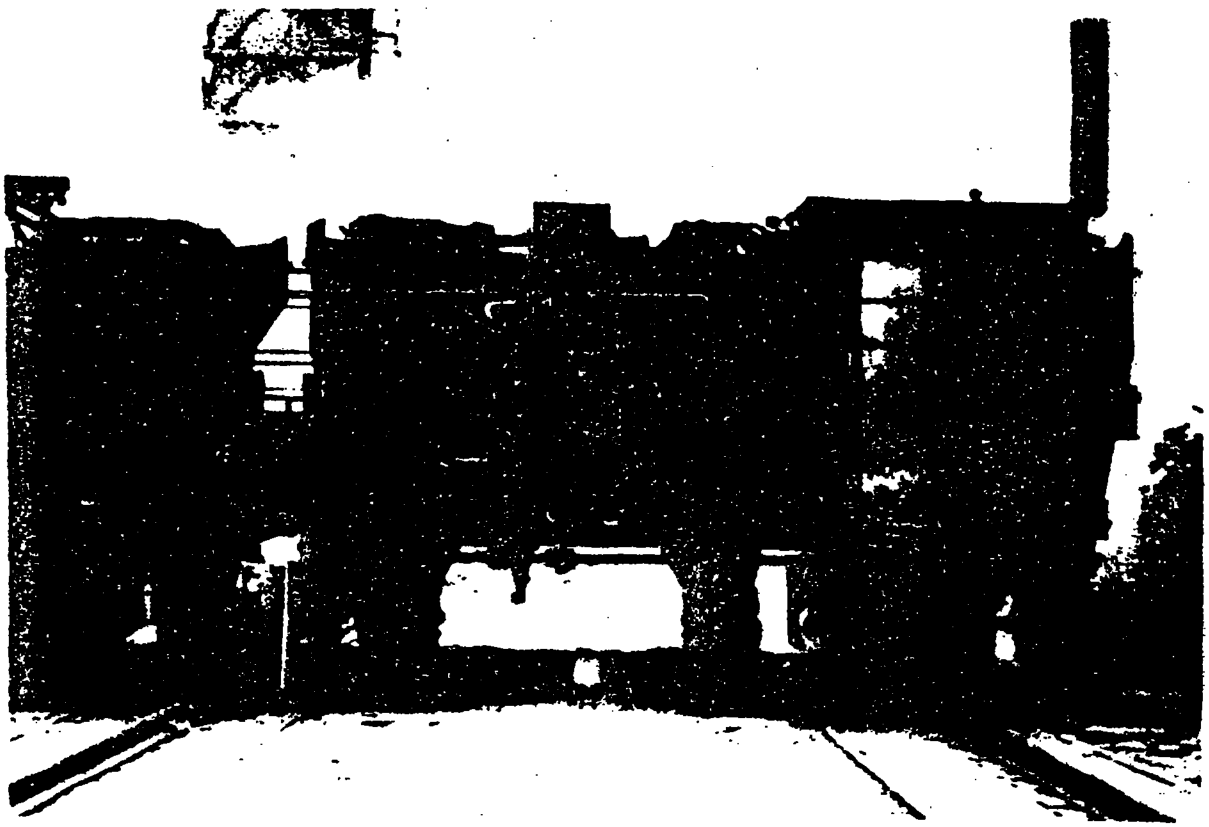

Figure 3-5. Larry Car

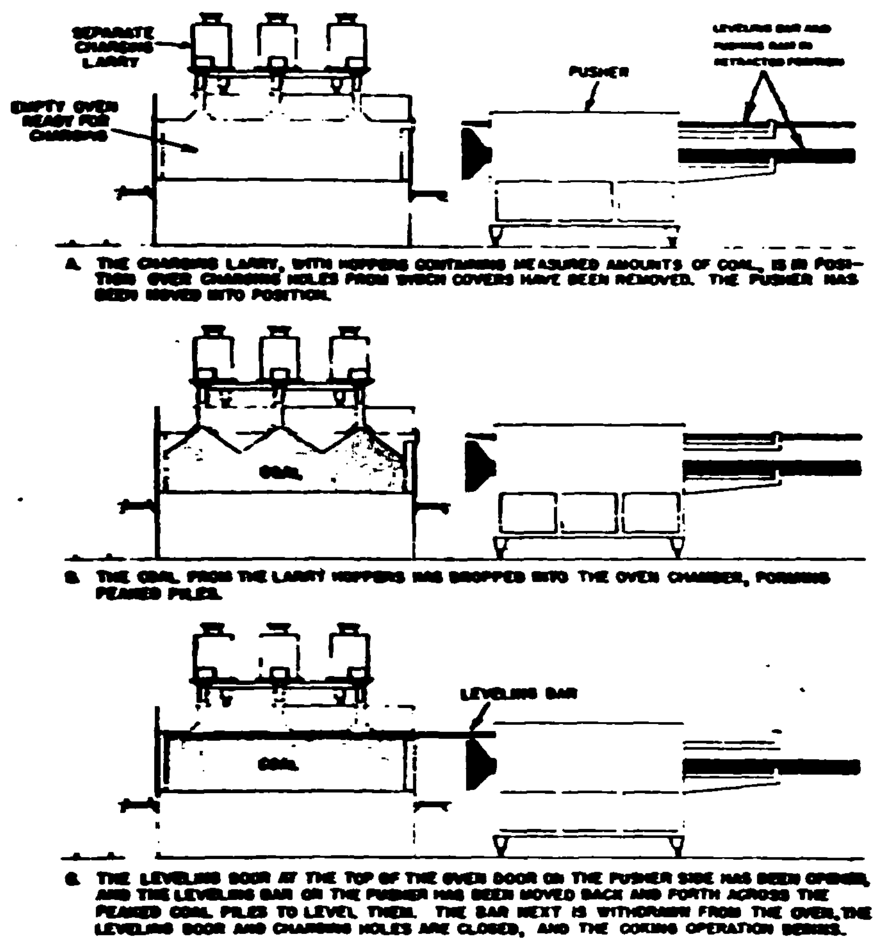

Figure 3-6. Charging and Leveling Operations for a By-Product Coke Oven

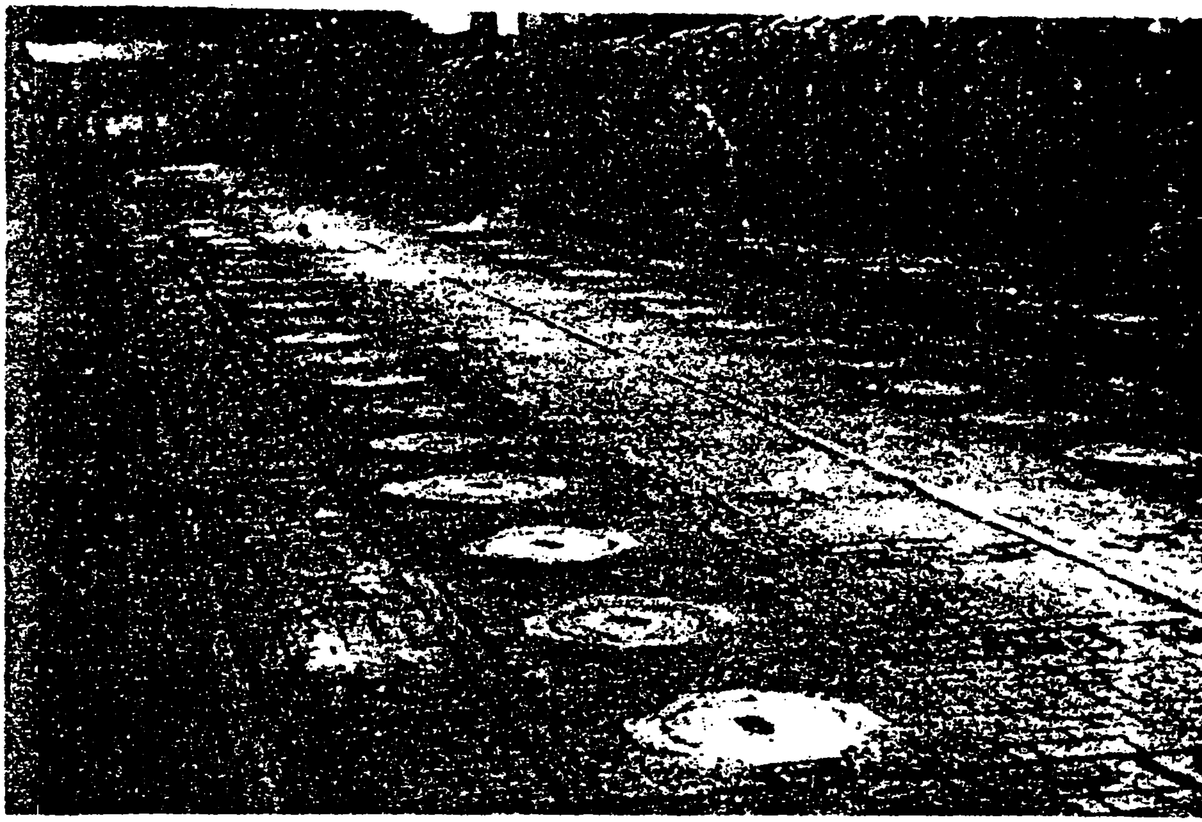

Figure 3-7. Topside of a Coke Oven Battery

After the coal has been leveled, the chuck door and all topside ports are closed. The latter may be sealed with a wet clay mixture. Coking then proceeds for, typically, 15 to 18 hours to produce blast-furnace coke and 25 to 30 hours to produce foundry coke. The coking time is a function of the mixture, moisture content of the coal, rate of underfiring, and the desired properties of the coke.

At the end of the coking cycle, doors at both ends of the oven are removed and the incandescent coke is pushed out the coke side [2] of the oven by a ram which is extended from the pusher machine. This operation is illustrated in Figure 3-8. The coke is pushed through a coke "guide" into a special open-hopper railroad car, called a quench or hot coke car. The quench car, which travels on rails along the coke side of the battery, carries the incandescent coke into a "quench tower" located at the end of the battery away from the coal-storage bunkers. There the coke is deluged with water and quenched from its temperature of 1100+°C.

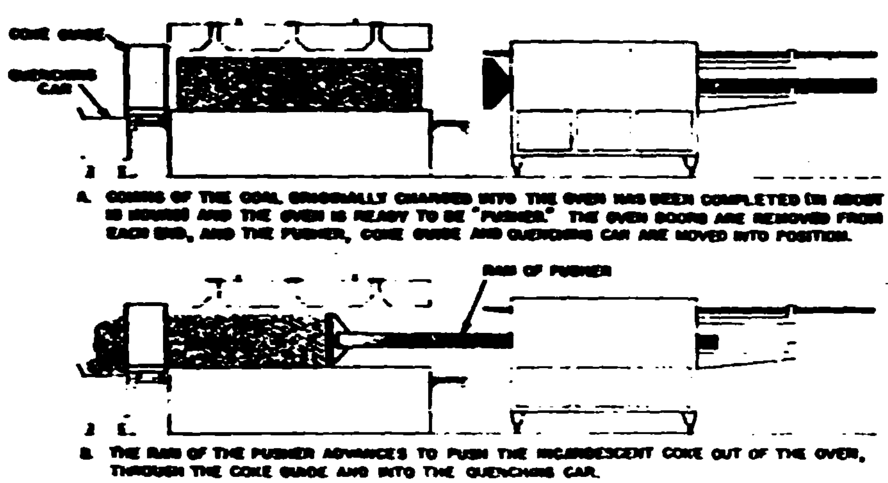

Figure 3-8. Pushing Operations for a By-Product Coke Oven

---

[2] Coke side designates the side of the battery where the quench or hot coke car is located.

The quenched coke is discharged from the hot coke car onto an inclined "coke wharf" to allow excess water to drain and the coke to cool to a reasonable handling temperature. Gates along the lower edge of the wharf control the rate the coke falls on a conveyor belt which carries it to the crushing and screening system. The coke is then crushed and screened to obtain the optimum size for its desired use. The breeze (undersize coke) generated by the crushing and screening operations is usually used at other steel-plant processes.

3.2.3 By-product Production

The gases evolved during coking leave the coke oven through the standpipes, pass into goosenecks and through a damper valve to the gas collection "main" which directs them to the by-product plant. Twenty to 35 percent by weight of the initial coal charge is evolved in this manner.

The gases are cooled to 80 to 100°C in the collection main by spraying with recycled "flushing liquor," the water and light portion of the liquid which condenses in the mains. The flushing liquor is so named because is serves as a carrying medium to flush the condensed tars and other viscuous compounds condensed in the main. They are separated from the liquor in the decanter.

The materials recovered from the main are processed to yield a variety of organic chemicals and chemical mixtures, such as benzene, toluene, xylene, solvent naphtha, crude chemical oil, and pitch. Ammonia is recovered either as an aqueous solution or a salt (e.g., ammonium sulfate).

The uncondensible gas remaining after the recovery steps is known as coke-oven gas. It is rich in hydrogen and methane and has a calorific value of 20.5 million joules per standard cubic meter (550 Btu per standard cubic foot). Typically, 35 to 40 percent is returned to fuel the coke oven combustion system. The remainder is used for other heating needs.

3.3 EMISSIONS FROM THE MANUFACTURE OF BY-PRODUCT COKE

The primary sources of dust, smoke, and organic emissions from by-product coke-oven plants are:

a. unloading, handling, and stockpiling coal;

b. handling, crushing, screening, and blending coal;

c. charging of coal into the coke ovens;

d. gas and smoke leakage from charging lids and standpipes;

e. underfiring of coke ovens (battery stacks);

f. gas and smoke leakage around coke-oven doors;

g. pushing of coke from the ovens;

h. quenching of hot coke;

i. handling, crushing, and screening of coke; and

j. the various sources at the chemical by-product plant.

This document will discuss only c and d above. Reasons for their selection as the first sources from coke ovens for which standards are to be prepared are discussed in Chapter 5. Standards will be developed for other sources in the future.

3.3.1 Charging of Coal Into Coke Ovens

When coal is introduced into the incandescent oven, the large volume of steam, gases, and smoke which forms is forced from the oven by the increasing pressure of the expanding gas volume within the confines of the oven. The steam is the consequence of the naturally occuring moisture in the coal and any water added during the grinding operations. Gases are generated by the volatilization and reactions of the volatile components of the coal and any oil that may have been added to the coal. The smoke is a combination of fume evolved with these gases and any particulate that may be entrained by them. As the expanding gas volume increases pressure in an oven, emissions will flow at high velocity from any openings such as an open charging port. The charging ports in an oven are open for only a relatively short period for a charge; however, since ovens are charged sequentially, the collective effect is a major source of emissions.

Particles emitted during the charging cycle have been identified as coke balls, pyrolitic carbon, high-temperature coke, char, coal, mineral matter, and fly ash.[2,3] Particulate samples collected at one plant showed an average of 57 percent tar.[4] Tar is synonymous with benzene soluble organics (BSO) or coal tar pitch volatiles (CTPV). Analysis of the tar from portions of the samples showed from 260 to 18,000 parts per million (by weight) benzpyrene, which includes 3,4 benzpyrene (benzo(a)pyrene). Other polycyclic organic compounds identified as present were:

benz(c)phenanthrene
benz(a)anthracene
a benzfluoranthene isomer
a benzfluoranthrene isomer
cholanthrene

These compounds are known or suspected to be carcinogenic. That carcinogenic compounds are emitted from coke ovens has been well documented.[5]

The distribution of particle sizes of the particulate emissions shows two distinct size groups.[6] The finer particles (47 percent of the total) have a mass mean diameter of 8.5 micrometers. The larger particles have a mass mean diameter of 235 micrometers. The tar portion of the particulate was found primarily with the finer particles.

Table 3-2 shows the results of an analysis of gaseous pollutants measured at one plant.[7] Another source separates the gaseous emissions into the following categories: nitrogen, nitrogen oxides, methane, hydrogen, carbon monoxide, carbon dioxide, polynuclear aromatic hydrocarbons, and coal tar pitch volatiles.[8]

Table 3-2. GASEOUS POLLUTANTS FROM CHARGING

Pollutant	Standard Cubic meters per charge[a]	Standard Cubic feet per charge[a]	Maximum concentration, ppm
Total hydrocarbons	0.96	34	
Carbon dioxide	0.83	29	
Carbon monoxide	0.50	17	
Nitrogen oxides	0.0031	0.11	
Sulfur dioxide			232
Hydrogen sulfide			42
Methane			4
Ammonia			130
Phenol			31
Cyanide			16

[a]Fourteen megagrams (15 tons) of coal per charge.

For this type of fugitive emissions source, collection of representative emission samples is extremely difficult and, consequently, very little data on mass rates are available. No reliable, quantitative measurements for POM's or BSO are known to be available. However, a compilation of available data on particulate emissions and results of one test that shows the percent BSO and BaP in charging emissions are available.

EPA with input from the American Iron and Steel Institute is compiling and analyzing data on particulate emissions from iron and steel mills to define emission factors for each process. Though not finalized, current information from this study suggests an emission factor for charging of about 0.5 grams of particulate per kilogram (1 pound/ton) of coal charged.[9] Estimated emission factors in the literature vary by at least an order of magnitude. This variation should be kept in mind as an indication of the accuracy of the emission factor.

One test has been conducted which indicates the percent organic in particulates from charging. Samples were collected by putting enclosures around the larry car drop sleeves and evacuating the emissions through a stack which could be sampled. The samples were collected with an Anderson Impactor or a cyclone and glass fiber filter, followed by impingers in an ice bath. Reliable results for total mass or organic emissions were not obtained from this test, but the percent BSO and some indication of the BaP content were obtained. The average percent BSO measured (excluding the impinger catch) was 57.[4] The impingers averaged 96 percent of the mass collected in the front of the sampling trains and contained an average of 60 percent BSO.[10]

Combining the particulate emission factor with these results, a BSO emission factor is calculated as follows. It is assumed that the particulate emission factor is based on data that does not reflect the BSO collected in impingers.

BSO emission factor = (1 x 0.57) + (1 x 0.96 x 0.60) = 0.55 grams BSO/kilogram of coal charged (1.1 pounds/ton)

1 = particulate emission factor
0.57 = percent BSO in "front half" particulate
0.96 = "impinger" particulate as percent of "front half"
0.60 = percent BSO in "impinger" particulate

Data on organic emissions from Russian and Czechoslovakian coke plants have also been reported.[11] The values reported as aromatic hydrocarbons or tar range from 0.0005 to 0.1 g/Kg (0.001 to 0.2 lb/ton) of coal. Mass emissions reported with these values were far below the 0.5 g/Kg particulate emission factor used above. Because that emission factor is based on a compilation of many sources of information, the BSO emission factor calculated from it is judged more realistic than the values reported here.

The data on B(a)P emissions from the study that the percent BSO was obtained are not sufficient to allow an emission factor to be calculated. Only selected portions of some samples were analyzed for BaP. The results varied considerably with values up to 3000 and one value at 18,000 ug/g^3 of BSO reported.[12] For 12 of 19 samples the BaP concentration was below detectable limits; which varied from 220 to 1400 ug/g of BSO depending on the sample size. If it is assumed the portion of the sample analyzed is representative of the entire sample, the 6 positive results (excluding the 1 high value) are equivalent to 2.8×10^{-4} to 17×10^{-4} g BaP/Kg of coal charged (5.6×10^{-4} to 33×10^{-4} lb/ton).

The emissions from charging cause large visible clouds of smoke and fumes. Figure 3-9 shows a typical uncontrolled charge, although at times the visible emissions can almost completely obscure the larry car. These emissions will last from when the coal starts to flow into the oven until the charging port lids are replaced, which is a period of about three minutes.

Figure 3-9. Uncontrolled Charge

Many variables can potentially influence the quantity of emissions during charging. (The effect of these variables on the control of emissions is discussed in Section 4.3.1.) Data are not available to quantify the effects of these variables; however, the possibilities can be discussed. A higher volatile content of the coal or the addition of more oil to the coal would be expected to result in a greater volume of gases and fume (more emissions) generated in the oven as these components decompose and burn. More moisture in the coal will also add to the volume of gases (as it is converted to steam) in the oven, which tends to force emissions into the atmosphere more rapidly. On the other hand, high moisture may retard the rate at which the temperature of the coal increases since evaporation of the water absorbs considerable heat. At lower temperatures, the coal volatiles and oil will not decompose or burn as fast which results in less gas generation and less emissions.

The fineness of grind, which determines the size of the coal particles, may be another factor that affects the emission rate. Finely ground coals should have a greater tendency to be entrained in the effluent gases and carried out of the oven than coarser ground coals. Also, the finer coal may volatilize faster and generate more gas in a short time.

3.3.2 Leakage from Charging-Port Lids and Standpipes

After a charge, the charging port lids must be replaced and the standpipe lids closed to isolate the oven from the atmosphere. Any leaks, caused for example by improperly seated or distorted lids, permit emissions to reach the atmosphere. The bodies of the standpipes can also leak. Cracks or a broken seal at the bottom of the standpipe are the most common causes of these leaks.

These emissions are expected to have a character similar to those from charging, without the larger particles of coal or coke. No measurements of mass emissions have been made; however, their rate is primarily affected by how well the charging port lids and standpipes are maintained and sealed.

REFERENCES FOR CHAPTER 3

1. Suta, Benjamin E., Human Population Expsoures to Coke-Oven Atmospheric Emissions, Prepared by Stanford Research Institute for the Environmental Protection Agency, Contract Number 68-01-4314, August, 1977, pp. 21 - 24.

2. Herrick, R. A., and Benedict, L. G., "A Microscopic Classification of Settled Particles Found in the Vicinity of a Coke-Making Operation," Journal of the Air Pollution Control Association, 19 (5), May, 1969, pp. 325 - 328.

3. Stolz, J. H., Coke Charging Pollution Control Demonstration, Environmental Protection Technology Series, EPA-650/2-74-022, American Iron and Steel Institute and Office of Research and Development, United States Environmental Protection Agency, March, 1974, 302 pp.

4. Bee, R. W., et. al., Coke Oven Charging Emission Control Test Program - Volume I, Environmental Protection Technology Series, EPA-650/2-74-062, Office of Research and Development, United States Environmental Protection Agency, July, 1974, p. 118.

5. Department of Health, Education, and Welfare, National Institute for Occupational Safety and Health, "Criteria for a Recommended Standard - Occupational Exposure to Coke Oven Emissions," 1973.

6. Op. Cit., Bee, p. 3.

7. Op. Cit., Bee, pp 94 and 97.

8. Smith, W. M., "Evaluation of Coke Oven Emissions," Yearbook of the AISI, American iron and Steel Institute, 1970, pp. 163 - 179.

9. McCutchen, G., EPA Memorandum to AISI/EPA Iron and Steel Committee Members, Enclosure 2, October 7, 1977, p. 2.

10. Op. Cit., Bee, Volume II, pp. B-19 and B-46. (Values in the text were derived from the data presented.)

11. White, et. al., "Atmospheric Emissions of Coking Operations - A Review," Tables IV and VI.

12. Op. Cit., Bee, Volume II, p. B-48.

EMISSIONS OF ORGANIC COMPOUNDS FROM
MILWAUKEE SOLVAY COKING OPERATIONS

PRELIMINARY DRAFT

Presentation by Thomas J. Manthey
Pickands Mather & Co.

Coking of bituminous coal causes the release of volatile matter in the coal at the Milwaukee Solvay Plant. These volatile compounds are ducted to a chemical process where various oils, tars, etc., are recovered. The non-recoverable gases are then burned. Atmospheric emissions of organic matter occur whenever the ovens are opened for charging or pushing, and through leaks in the oven doors during the 24 to 25 hour coking period.

Quantitative hydrocarbon emission data from by-product coking operations are almost non-existent. Limited data assembled by the Federal Environmental Protection Agency in their compilation of emission factors shows that approximately 4.2 pounds of hydrocarbons are emitted per ton of coal charged. Of this total emission, about 60% is emitted during charging, 36% during coking, and 4% during pushing or discharging.

An examination of the data upon which these generalized factors were based, shows that approximately 75% of the charging emissions are composed of methane, a non-reactive hydrocarbon, which is usually present in the atmosphere. The volatile matter in the coal used at Milwaukee Solvay is less than 23% by weight. Coal used for blast furnace coke, upon which the EPA factor was based usually contains about 30% volatile

Emissions of reactive hydrocarbons during coking were estimated to be 0.28 pounds per hour, based on the fact that only one-half of the total emissions are reactive.

$$1.5 \text{ lb/ton} \times .5 = 0.75 \text{ lb/ton} \times \frac{9 \text{ ton}}{24 \text{ hours}} = 0.28 \text{ lbs.}$$

of reactive HC per hour.

Pushing emissions of hydrocarbons are very small and only account for about 4% of the total coking emissions. The longer coking time - 24 to 25 hours - used at Milwaukee tends to almost eliminate hydrocarbon emissions from pushing operations since very little volatile matter remain in the finished coke.

We therefore feel that the Milwaukee Solvay plant complies with the intent of Wilconsin Regulation NR 154.13 and that it does not emit reactive hydrocarbon compounds in excess of the prescribed limits of 3 pounds in any one hour or 15 pounds in one day.

Alternatively we can demonstrate compliance in that emission from the overall coking operation have been reduced by more than 85% . Uncontrolled emissions from coal coking could be construed to be those emissions which are generated before recovery. Based on a typical coke oven gas containing 35% methane and a gas generation rate of 10,000 ft^3/ton of coal, approximately 155 pounds of methane would be emitted per ton of coal. The actual estimated emission rate of 4.2 pounds per ton of coal represents a reduction of 97%.

matter. With a lower volatile content coal, emissions during charging would be lsss than the reported emission factor value. In addition, the shorter charging time, and increased suction on the oven during charging as described by Mr. Lenz will decrease total charging emissions.

Emissions of reactive hydrocarbons during charging have been estimated by our consultants to be on the order of 1.9 pounds per charge. This was computed by taking one-fourth of the reported emission factor as a non-methane hydrocarbon, multiplying this value by two-thirds to account for the lower volatile content coal, and taking half of this final value as being in a non-reactive form -- mainly benzene.

(2.5 lb/ton X 0.25 X 0.67 X 0.5)= 0.21 lb/ton of coal charged

0.21 lbs/ton X 9 tons of dry coal = 1.9 lbs. reactive HC emitted

This emission occurs over a 3 to 5 minute period.

Hydrocarbon emissions during the coking cycle occur mainly through leaks in the oven. Limited reported data show that these emissions are also largely methane. Laboratory tests conducted by our consultant show an average of 46% methane evolved during simulated coking. The lower coking temperature used at our Milwaukee Plant - 1900°F compared to 2200°F at a conventional plant - would tend to reduce emissions during coking since less expansion takes place. The effective maintenance program at our plant also reduces leakage emissions during coking.

8-17-05-a

PEDCo-ENVIRONMENTAL
SUITE 13 • ATKINSON SQUARE
CINCINNATI, OHIO 45246
513/771-4330

RECEIVED
JAN 22 1974
T. J. MANTHEY

New file
MB
E.M.

January 19, 1973

Mr. Thomas J. Manthey
Director, Public Affairs
Pickands Mather & Co.
1100 Superior Avenue
Cleveland, Ohio 44114

Dear Mr. Manthey:

In regard to consulting services to be provided for Pickands Mather & Co. in support of their response to the U.S. Environmental Protection Agency Notice of Violation (Milwaukee Solvay Coke Plant) dated January 9, 1974, PEDCo-Environmental is pleased to propose the following scope of work:

° Task 1 - Perform a complete and detailed emissions inventory of the Milwaukee Solvay Coke plant complex for the following pollutants; particulates, sulfur dioxide, hydrocarbons, carbon monoxide, and hydrogen sulfide. We will develop emission factors specific for this plant's operations and raw materials usage. All data will be developed from on-site observations, literature references, and calculations. No source testing by PEDCo-Environmental will be involved. We will also visit the Chicago EPA office to discuss our results and compare calculations with appropriate Federal staff. Three copies of a report covering all aspects of this task, documented as required, will be submitted on or before February 19, 1974.

° Task 2 - The Wisconsin State air pollution laws do not directly apply to emissions from coking operations, however it is our opinion that the rule which applies to other processes which involve the use of heat and restricts the gaseous hydrocarbon emissions to 15 lbs. per day could be applied to each of the coking ovens. Therefore in an effort to determine the quantity of gaseous hydrocarbon emissions from the ovens, we propose to measure the quantity of gaseous hydrocarbons which are liberated during the coking process. In order to accomplish this task, three samples of the coal most commonly used by the Milwaukee Solvay plant, will be distilled in the absence of air and the gaseous volatile hydrocarbon

PEDCO

products will be collected at ambient temperature and their mass (expressed as methane) determined using gas chromatography with flame ionization detection. In addition to this measurement, the methane content of this gaseous fraction will also be determined and subtracted from the total hydrocarbon content. The purpose of this subtraction is to arrive at a value for "total hydrocarbons less methane" which is presently used by the Federal EPA for the measurement of ambient levels of hydrocarbons.

As a result of this study, we will be able to determine the maximum possible gaseous hydrocarbon emissions from coking the type of coal presently used at the Milwaukee Solvay Coke plant. We feel that there is a good possibility that the level of gaseous hydrocarbons, emitted during a 24-hour period, will be less than 15 lbs. per coke oven. The same reporting conditions specified in Task 1 apply.

° Task 3 - I will personally review the Notice of Violation and prepare my recommendations for your position in response to the allegations presented in the citation. This information can be supplied by February 8th if required.

Our firm-fixed-price for each of the above tasks is:

Task 1 - $4,600
Task 2 - $1,800
Task 3 - $1,000.

These costs include all labor, travel, other expenses, and fee. My time plus expenses incurred on 1/17/74 are included in Task 3 costs.

Should you require either Mr. Gerstle or me to be present at either State or Federal Hearings, our standard fee of $300/day plus expenses will apply.

Tom, it was a real pleasure to meet with you again and we appreciate the opportunity to respond to your request. Please advise me of your decision in this matter as soon as possible.

Sincerely,

PEDCo-ENVIRONMENTAL SPECIALISTS, INC.

George A. Jutze
President

GAJ:mam

cc: Mr. Richard W. Gerstle